Rhode Island GHG Emissions Reduction Study

Meeting No. 5
Providence, RI

October 5, 2016

Review of Phase 1 Options & Initial Results

Current Status

- Developed Phase 1 list of 10 GHG mitigation options with penetration assumptions
- Put into LEAP and evaluated against 2050 RI GHG target
- Did not get to 80% reduction target
- Now revising measures and assumptions

Keep in Mind

- These are draft initial results
- Results are preliminary and will change as analysis proceeds

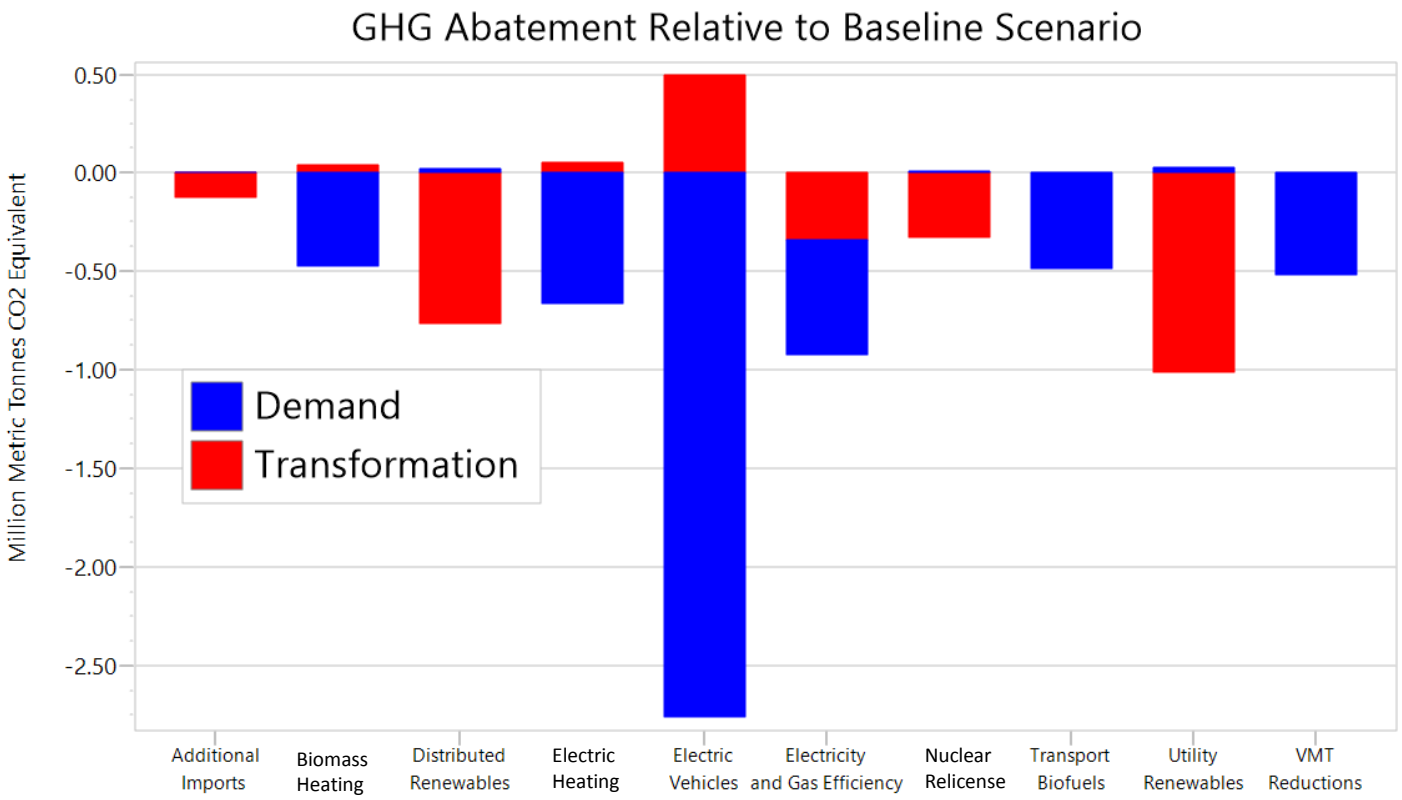
Initial List of 10 Measures (1-5)

1. Efficiency: newly added savings in electricity + gas consistent with RI State Energy Plan BAU Forecast, extrapolated to 2050 and distillate fuel oil
2. VMT reduction: up to 10% reduction by 2050
3. Utility-scale renewables: ~85% generation in 2050
4. Distributed solar PV: ~30% generation by 2050
5. Additional imports low-carbon electricity from out-of-region: one 1090 MW line

Initial List of 10 Measures (6-10)

6. Nuclear re-licensing: Millstone units 2 & 3 re-licensed through 2050
7. Electric heat in buildings: ~90% heated area by 2050 (heat pumps)
8. Biomass and biofuels for buildings: up to 30% heating demand in 2050
9. Light-duty electric vehicles: 80% of fleet in 2050
10. Advanced biofuels for transportation: By 2050, biodiesel up to 31% of diesel demand; cellulosic ethanol up to 79% of combined gasoline and ethanol demand

GHG Reductions of Each Measure



Total abatement from *individual measures*: 7.39 MT CO_2e

6.22 MT CO_2e excluding Biomass Heating and Distributed Renewables

Combined Measures

- Baseline (left) compared with "Kitchen sink" (right) scenario, ~62% GHG reductions from 1990 level

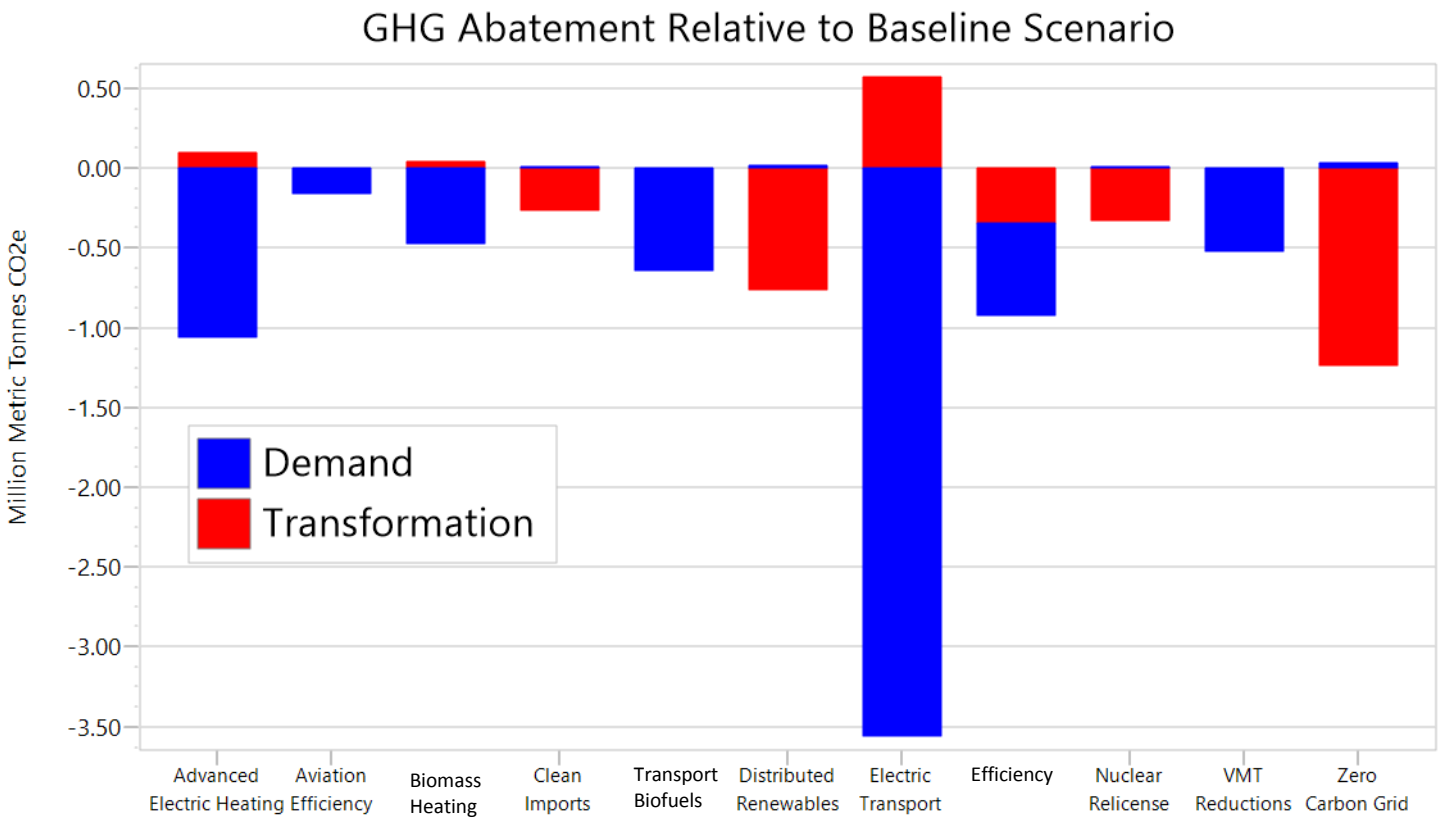
Branches	2010	2050
Demand	8.11	8.95
Residential	2.24	1.40
Transportation	4.48	5.78
Industry	0.61	0.59
Commercial	0.92	1.23
Electricity Exports	-0.15	-0.04
Transformation	2.61	1.67
Transmission and Distribution	0.18	0.19
Electricity Generation	2.44	1.47
Non Energy	-0.42	-0.27
Agriculture	0.02	0.06
Solid Waste	0.39	0.41
Wastewater	0.08	0.09
Industrial Processes	0.43	0.53
Land Use Change and Forestry	-1.34	-1.35
Total	10.31	10.35

Branches	2010	2050
Demand	8.11	4.74
Residential	2.24	0.83
Transportation	4.48	2.45
Industry	0.61	0.59
Commercial	0.92	0.89
Electricity Exports	-0.15	-0.01
Transformation	2.61	0.52
Transmission and Distribution	0.18	0.15
Electricity Generation	2.44	0.37
Non Energy	-0.42	-0.27
Agriculture	0.02	0.06
Solid Waste	0.39	0.41
Wastewater	0.08	0.09
Industrial Processes	0.43	0.53
Land Use Change and Forestry	-1.34	-1.35
Total	10.31	5.00

Additional Measures Towards 80% Target

- Nearly zero-carbon electricity grid by 2050
- Added zero-carbon measures for larger vehicle classes
  - Buses – 80% zero-carbon
  - Refuse trucks – 95% zero-carbon
  - Single unit long-haul – 80% zero-carbon
  - Combination short-haul & long-haul – 65% zero-carbon
- Rail: 100% electric
- Aviation: 40% fuel efficiency improvement by 2050
- Added second low-carbon transmission line at 1090 MW

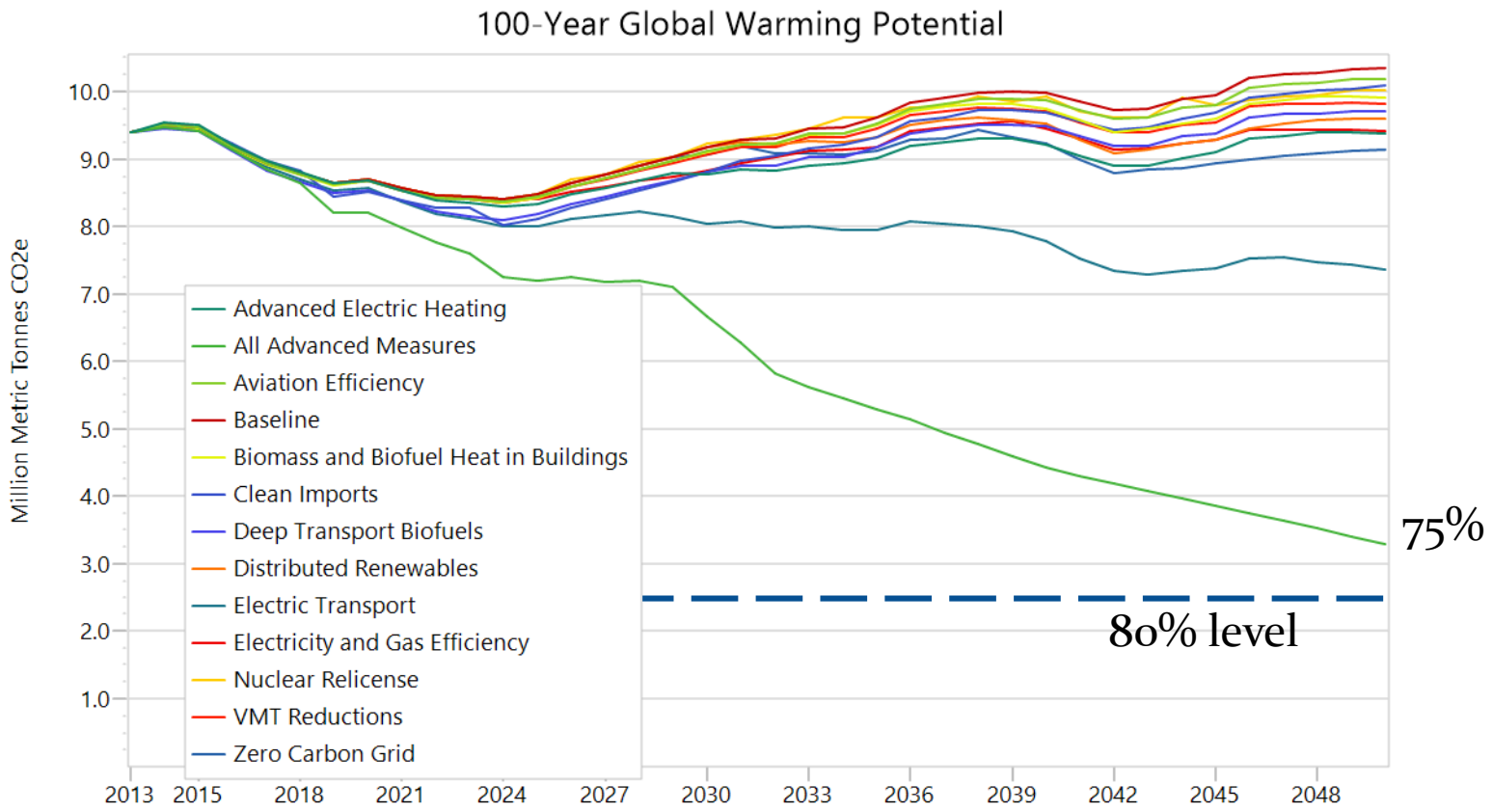
GHG Reductions of Each Measure



Total abatement from *individual measures*: 9.15 MT CO_2e

7.97 MT CO_2e excluding Biomass Heating and Distributed Renewables

GHG Reductions, Combined Policy



Combined Measures v.2

Branches	2010	2050
Demand	8.11	3.40
Residential	2.24	0.67
Transportation	4.48	1.44
Industry	0.61	0.59
Commercial	0.92	0.71
Electricity Exports	-0.15	-0.00
Transformation	2.61	0.15
Transmission and Distribution	0.18	0.14
Electricity Generation	2.44	0.02
Non Energy	-0.42	-0.27
Agriculture	0.02	0.06
Solid Waste	0.39	0.41
Wastewater	0.08	0.09
Industrial Processes	0.43	0.53
Land Use Change and Forestry	-1.34	-1.35
Total	10.31	3.29

- 80% below 1990 levels = 2.6 MT CO2e
- Total abatement from combined scenario = 7.06 MT CO2e (< sum of individual measures)

Next Steps

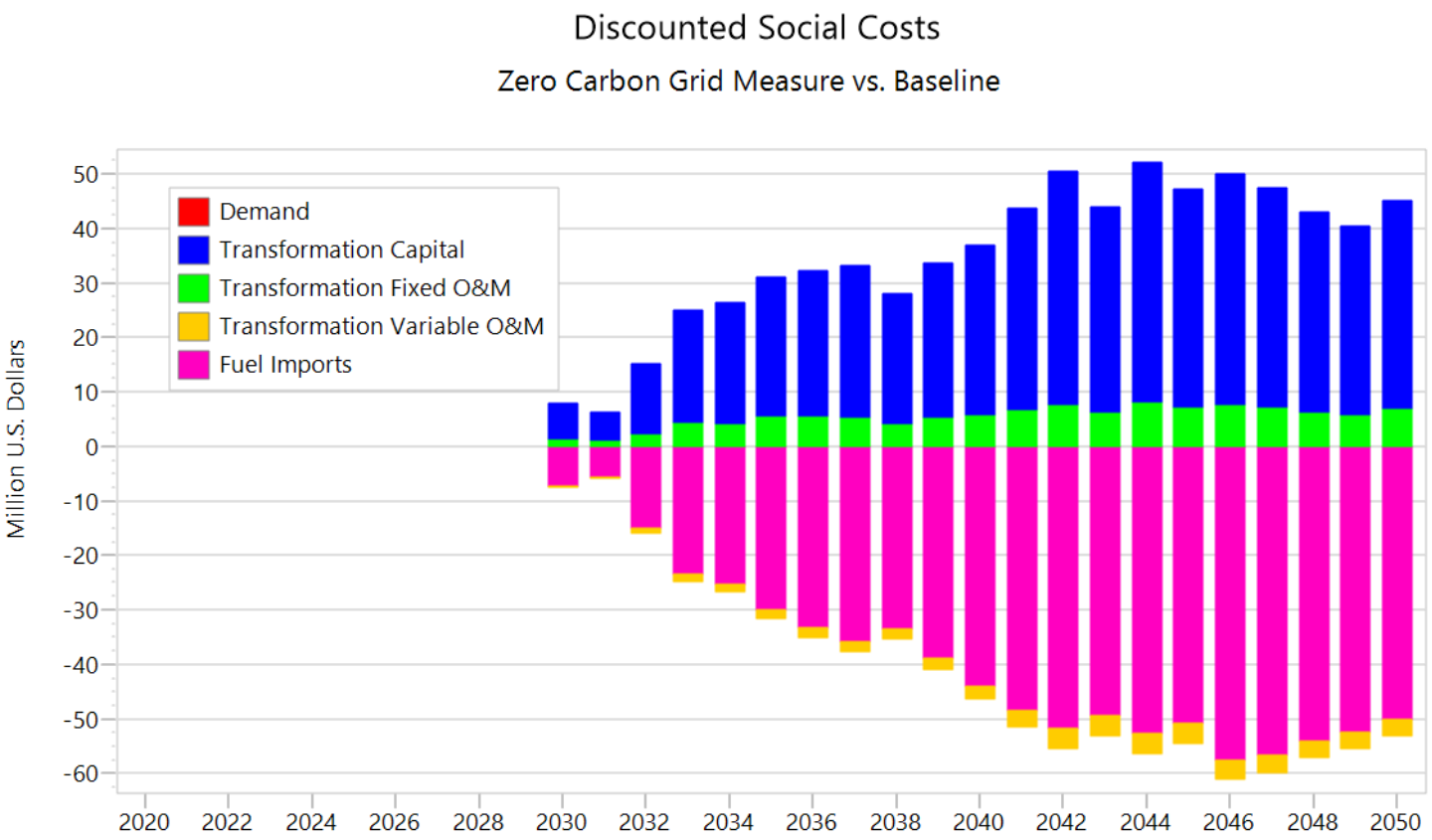
- Review Phase 2 process with State Team
- Some places still to look for ~0.7 MMtonne reduction:
  - More from transportation
  - Land use as additional CO2 sink
  - Non-energy GHGs
    - Solid Waste ~0.4 MMtonne (methane)
    - Industrial processes ~0.5 MMtonne (ozone depleting substances)
  - Industrial sector (many types)
  - Commercial sector – additional segments
- This continues to evolve…

Additional Feedback

- Can email written comments to Pam Sherrill, sherrill6@cox.net
  - October 19 requested deadline

- Send technical questions to Jason Rudokas, NESCAUM, jrudokas@nescaum.org

Example of LEAP output



Example of LEAP output